Stoller
Grand Junction Office established 1959

299-E33-26 (A4850)
Log Data Report

Borehole Information:

Borehole: 299-E33-26 (A4850)			Site: 216-B-61 Crib		
Coordinates (WA State Plane)		GWL (ft)[1]: 236.72		GWL Date: 9/17/2002	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
137,681.47 m	573,333.35 m	Feb. 1969	193.88 m	240	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.4	6 5/8	6	5/16	0	241

The logging engineer measured the casing stick up using a steel tape. A caliper was used to determine the outside casing diameter. The caliper was measured using a steel tape and rounded to the nearest 1/16 in. Inside casing diameter was measured using a steel tape and also rounded to the nearest 1/16 in. Casing thickness was calculated. Casing bottom is as reported from the well construction summary report.

Borehole Notes:

Borehole coordinates, elevation, and well construction information, as shown in the above tables, are from measurements by Stoller field personnel and Ledgerwood (1993). The depths have been adjusted to TOC. Zero reference is the top of the 6-in. casing. TOC stickup is evenly cut. A reference point survey "X" is located on TOC stickup. Surrounding the casing, a 4-ft x 4-ft x 6-in. concrete pad covers the ground surface. Surface grout extends to 21 ft (Ledgerwood 1993). The casing is perforated from 201 through 222 ft (Ledgerwood 1993). Duratek Federal Services measured depth to water when they removed the groundwater pump and tubing before logging began.

Logging Equipment Information:

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	09/2002	Calibration Reference:	GJO-2002-287-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	
Date	09/19/02	09/20/02	09/23/02	09/24/02	09/24/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	2.5	239.5	163.0	234.0	68.0
Finish Depth (ft)	32.0	163.0	67.0	210.0	31.0
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A[3]	N/A	N/A	N/A	N/A
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	BB134CAB	BB135CAB	BB136CAB	BB137CAB	BB137CAB
Start File	BB134000	BB135000	B136000	BB137000	BB137049

Log Run	1	2	3	4	
Finish File	BB134059	BB135153	BB136194	BB137048	BB137123
Post-Verification	BB134CAA	BB135CAA	BB136CAA	BB138CAA	BB138CAA
Depth Return Error (in.)	0	0	0	N/A	0
Comments	No fine-gain adjustment.	No fine-gain adjustment.	Fine-gain adjustment after file BB136176.	Repeat section. No fine-gain adjustment.	Fine-gain adjustments after files BB137057 and -092.

Logging Operation Notes:

Zero reference was top of the casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 082.

Analysis Notes:

Analyst:	Sobczyk	Date:	10/10/02	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all within the control limits. The peak counts per second at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were lower and between 3 and 9 percent of one another.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G2BSep02.xls), using parameters determined from analysis of recent calibration data. Zero reference is the top of the casing. The casing configuration was assumed to be one string of 6-in. casing with a thickness of 0.280 in. to a depth of 240 ft. A casing thickness of 0.280 in. is the published value for ASTM schedule-40 steel pipe (a commonly used casing material at Hanford). This casing thickness is within the range of measurement error associated with the logging engineer's measurements. A water correction was applied to the SGLS data below 236.7 ft. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 609 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 1764 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs and ^{60}Co were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in the borehole from the ground surface to 7.0 ft with a maximum concentration of 0.5 pCi/g at a log depth of 6.0 ft. ^{137}Cs was also detected at 30.5, 184.5, 205, and 227.5 ft with concentrations between 0.2 pCi/g and

0.3 pCi/g. ^{60}Co was detected in the interval from 232.5 ft through total depth (239.5 ft). The range of concentrations was from the MDL (0.1 pCi/g) to 1.7 pCi/g, which was detected at 238.5 ft. ^{60}Co was detected below the groundwater depth of 236.7 ft. A 1408-keV photopeak was detected at 101.5 ft. Confirming photopeaks for ^{152}Eu were not apparent in this spectrum. This peak is probably a ^{214}Bi peak (indicative of natural ^{238}U), and it was not included in the log plots.

Recognizable changes in the KUT logs occurred in this borehole. Changes of about 4 pCi/g in apparent ^{40}K concentrations occur at approximately 22 and 52 ft. The relatively low (less than 5 pCi/g) concentrations of ^{40}K above 22 ft are due to the surface grout. The increase in ^{40}K concentrations at 52 ft corresponds with and the transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2. At 135 ft, the change in apparent ^{40}K concentrations may be due to the difference in tool sensitivity at the beginning of log run 3 versus the end of log run 2. ^{232}Th concentration increases by about 0.5 pCi/g from 195 through 196 ft with a corresponding 50-cps increase in total gamma.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for both the man-made and natural radionuclides (661, 1173, 1333, 609, 1461, 1764, and 2614 keV). In addition, ^{137}Cs was detected at 221.5, 226.0, and 231.0 ft at an activity near its MDL of about 0.2 pCi/g on the repeat log run and not on the original log run. The 1333-keV repeat log detected ^{60}Co at activities near the MDL at 227.5 ft while the original log run did not detect ^{60}Co at this depth based on the 1333-keV photopeak.

Comparison log plots of data collected in 1992 by Westinghouse Hanford Co. (WHC) and in 2002 by Stoller are included. The 1992 concentration data for ^{60}Co and ^{137}Cs are decayed to the date of the SGLS logging event in September 2002. The SGLS and 1992 RLS logs appear to use a different depth reference, and the 1992 log was shifted from a ground level reference to a TOC reference. On the 2002 logs, the apparent ^{60}Co concentrations below 238 ft are slightly higher than that predicted by decay alone when compared to the 1992 log. Since 1992, ^{137}Cs activities appear to have decreased as predicted by radioactive decay.

Gross gamma profiles from Additon et al. (1978) (attached) also detected gamma-ray-emitting contamination. Logs from 4/24/70 and 5/4/76 detected elevated gamma-ray activity above background in the interval below 230 ft (70 m). The SGLS detected ^{60}Co in the interval from 227.5 to 239.5 ft with a maximum activity of 1.7 pCi/g.

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Well*s, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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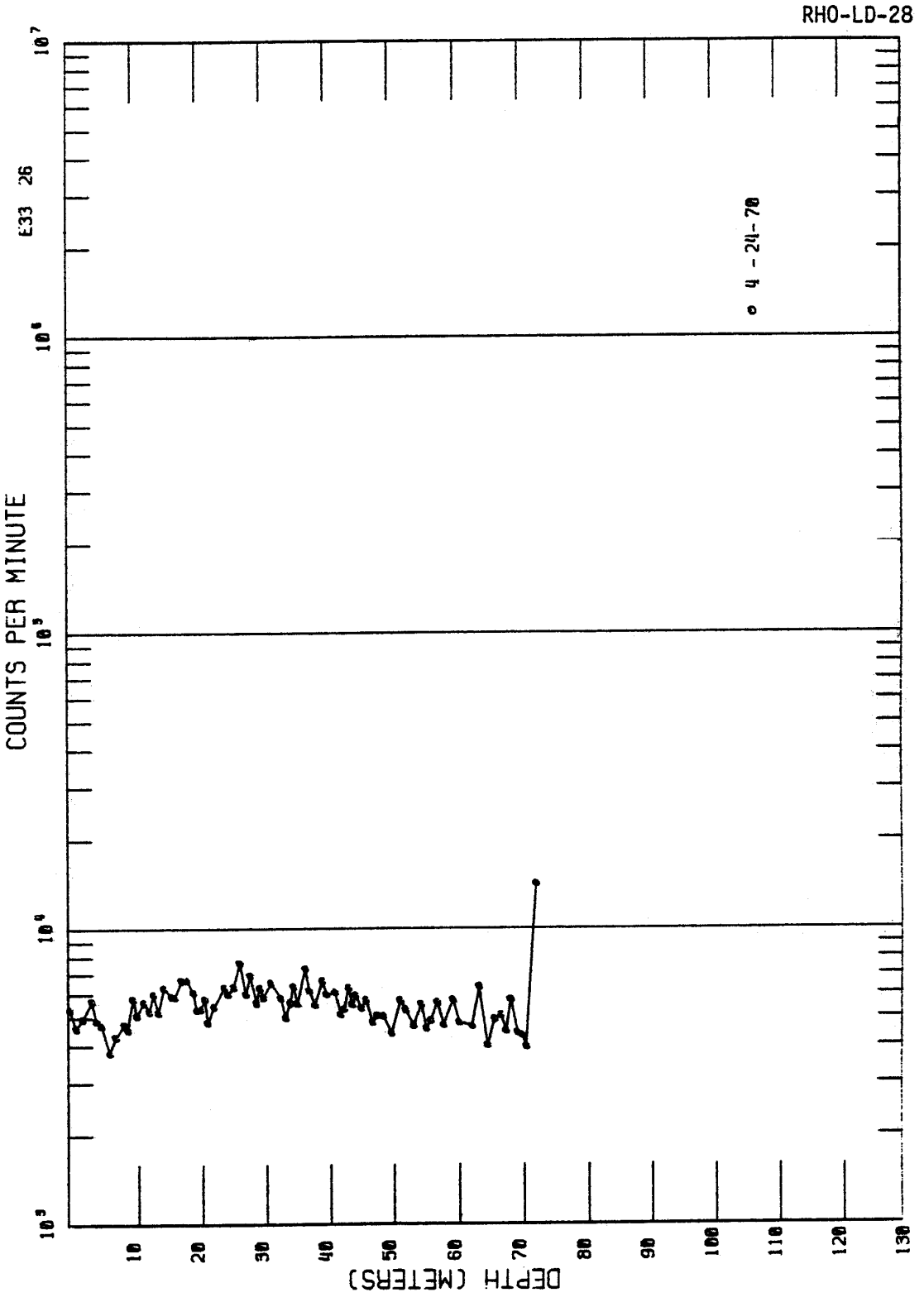
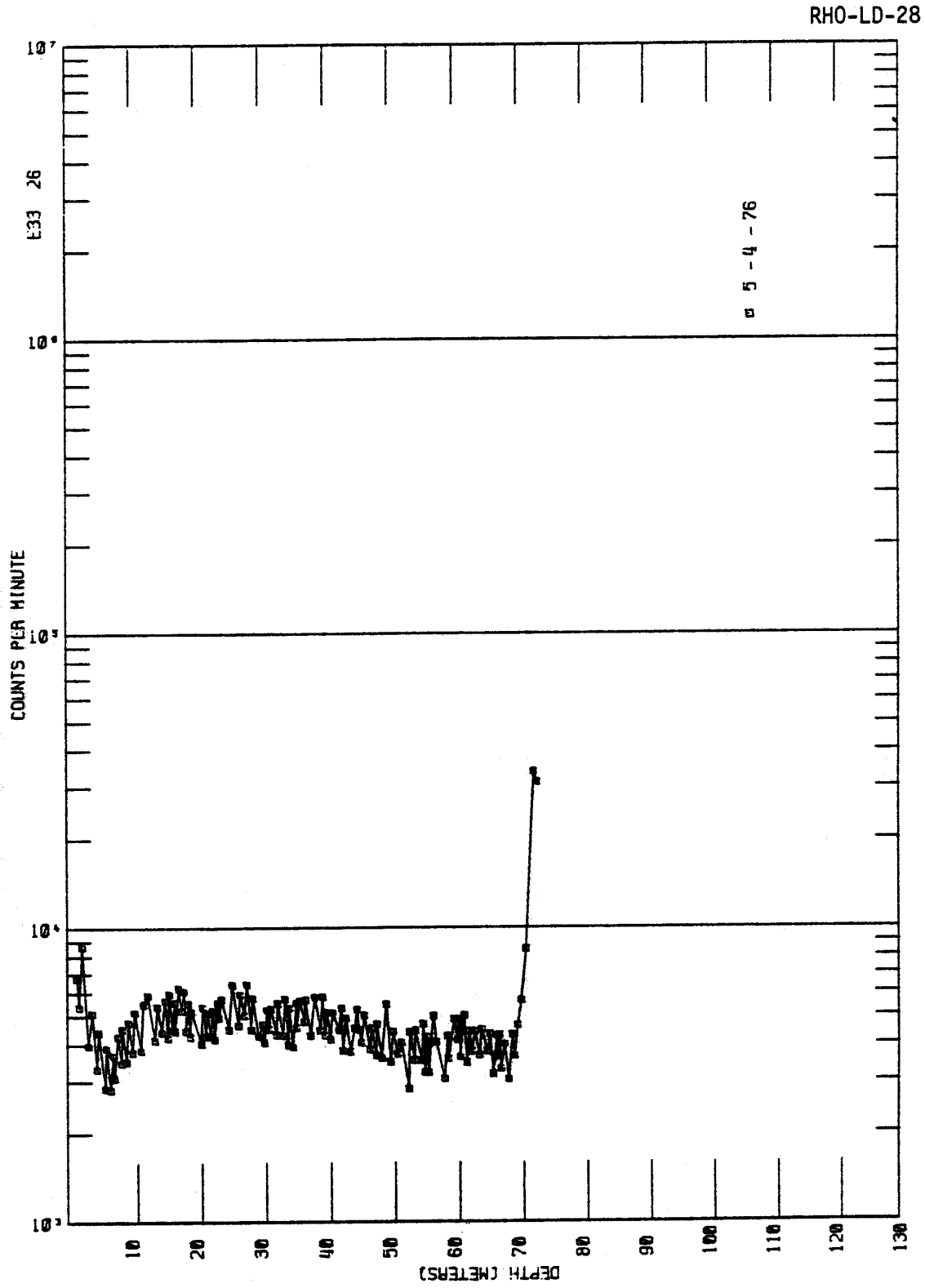
[1] GWL – groundwater level
[2] TOC – top of casing
[3] n/a – not applicable



from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E33-26, Logged on 4/24/70

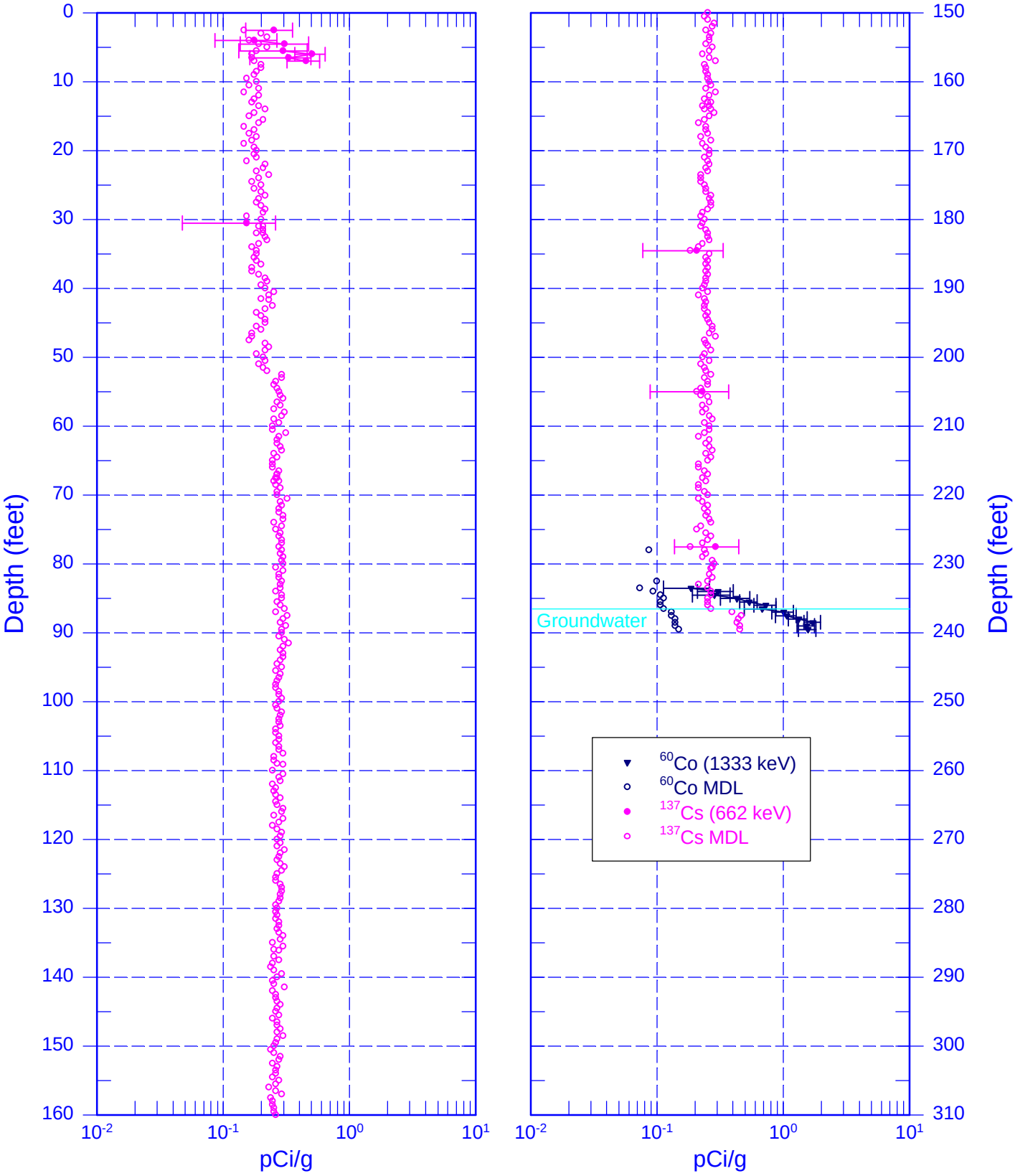


from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E33-26, Logged on 5/4/76

299-E33-26 (A4850)

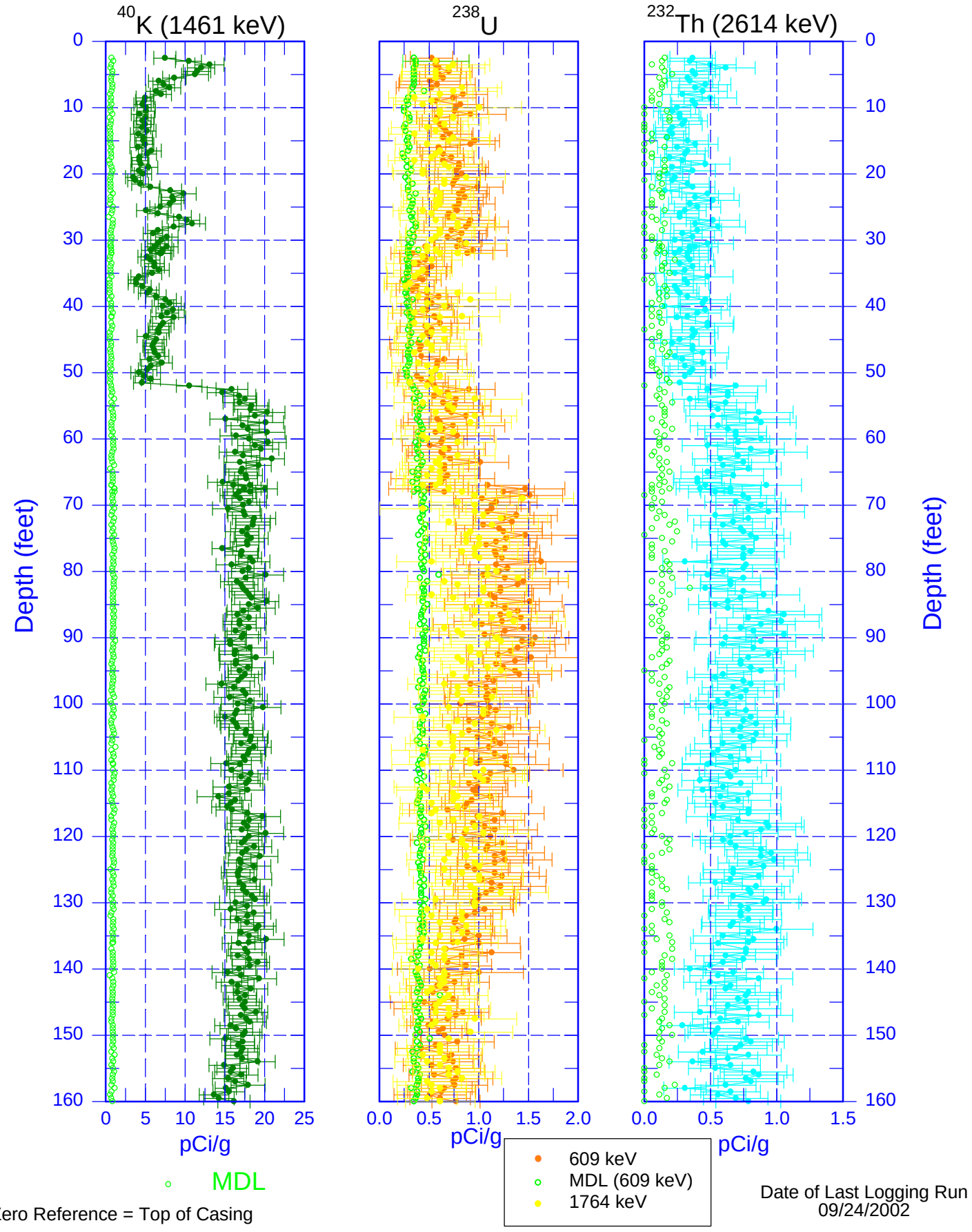
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
09/24/2002

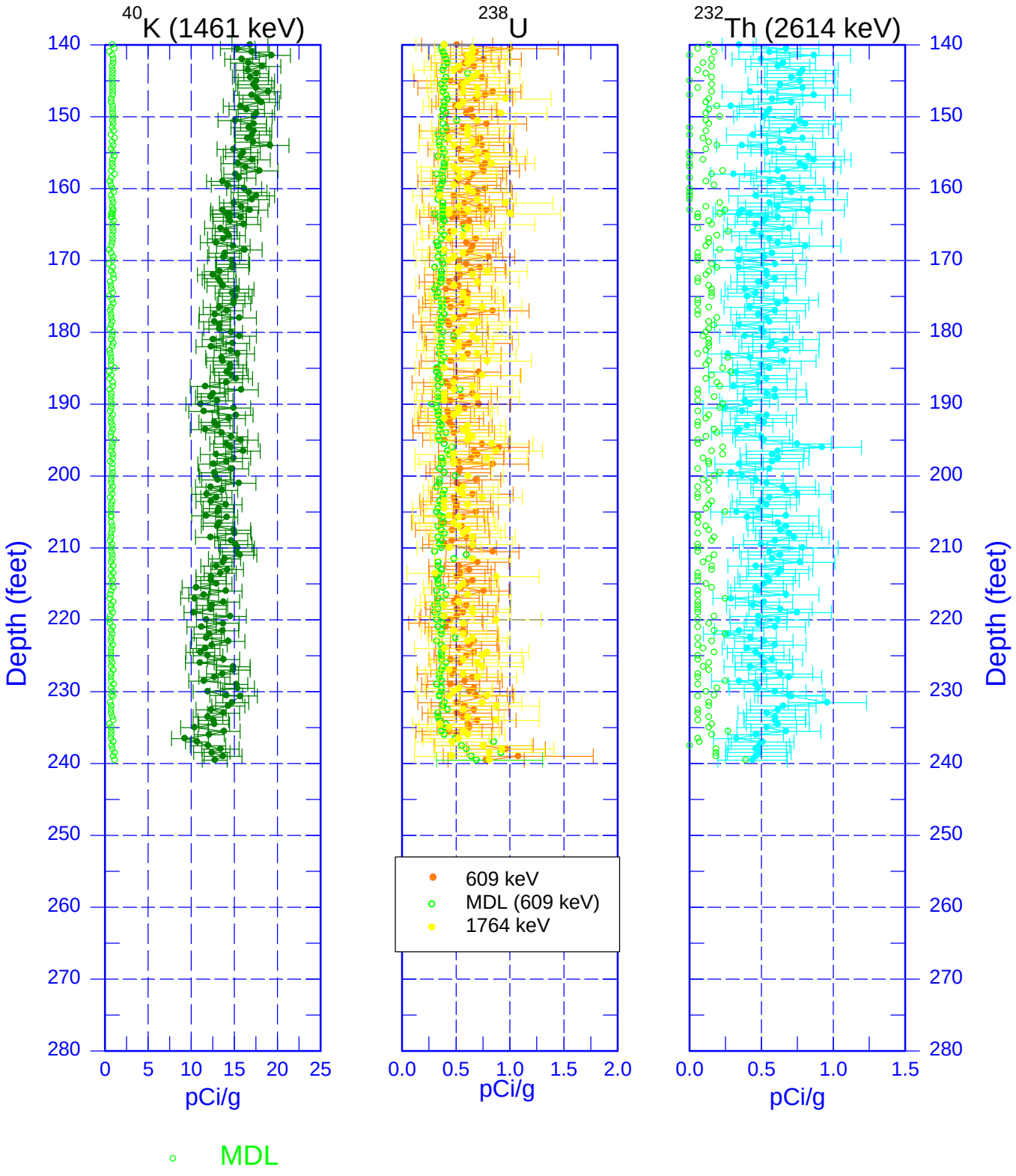
299-E33-26 (A4850)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
09/24/2002

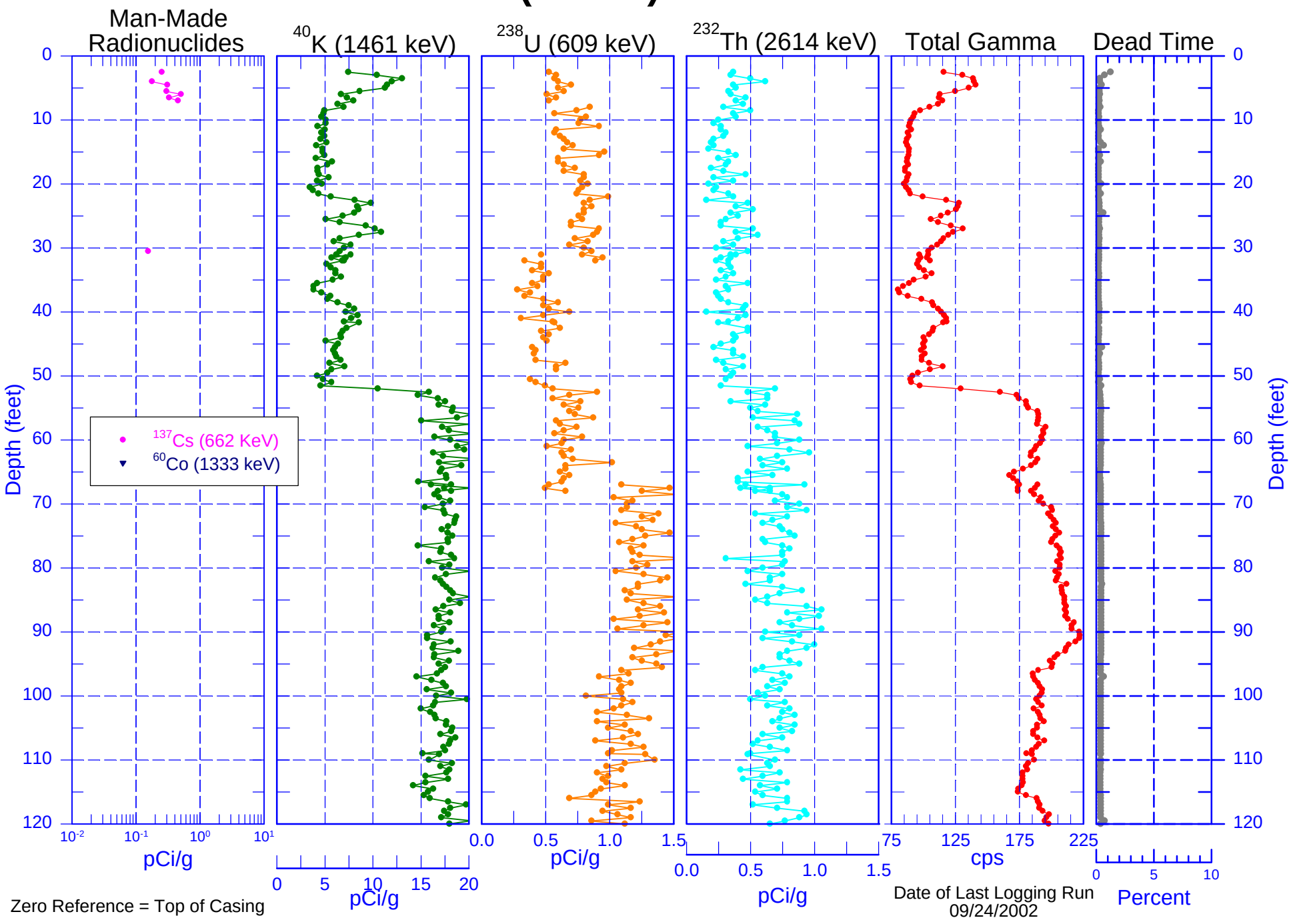
299-E33-26 (A4850)
Natural Gamma Logs



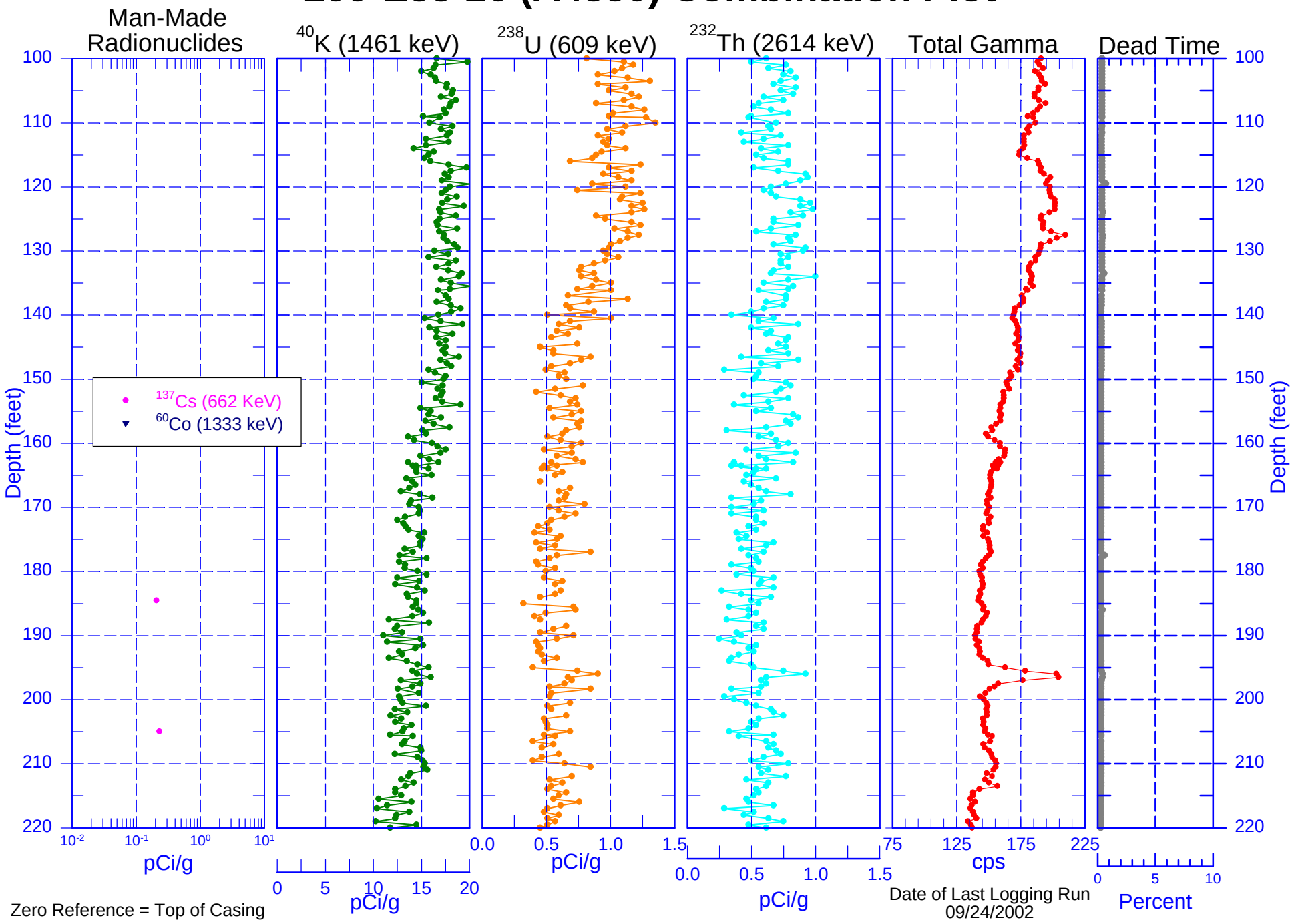
Zero Reference = Top of Casing

Date of Last Logging Run
09/24/2002

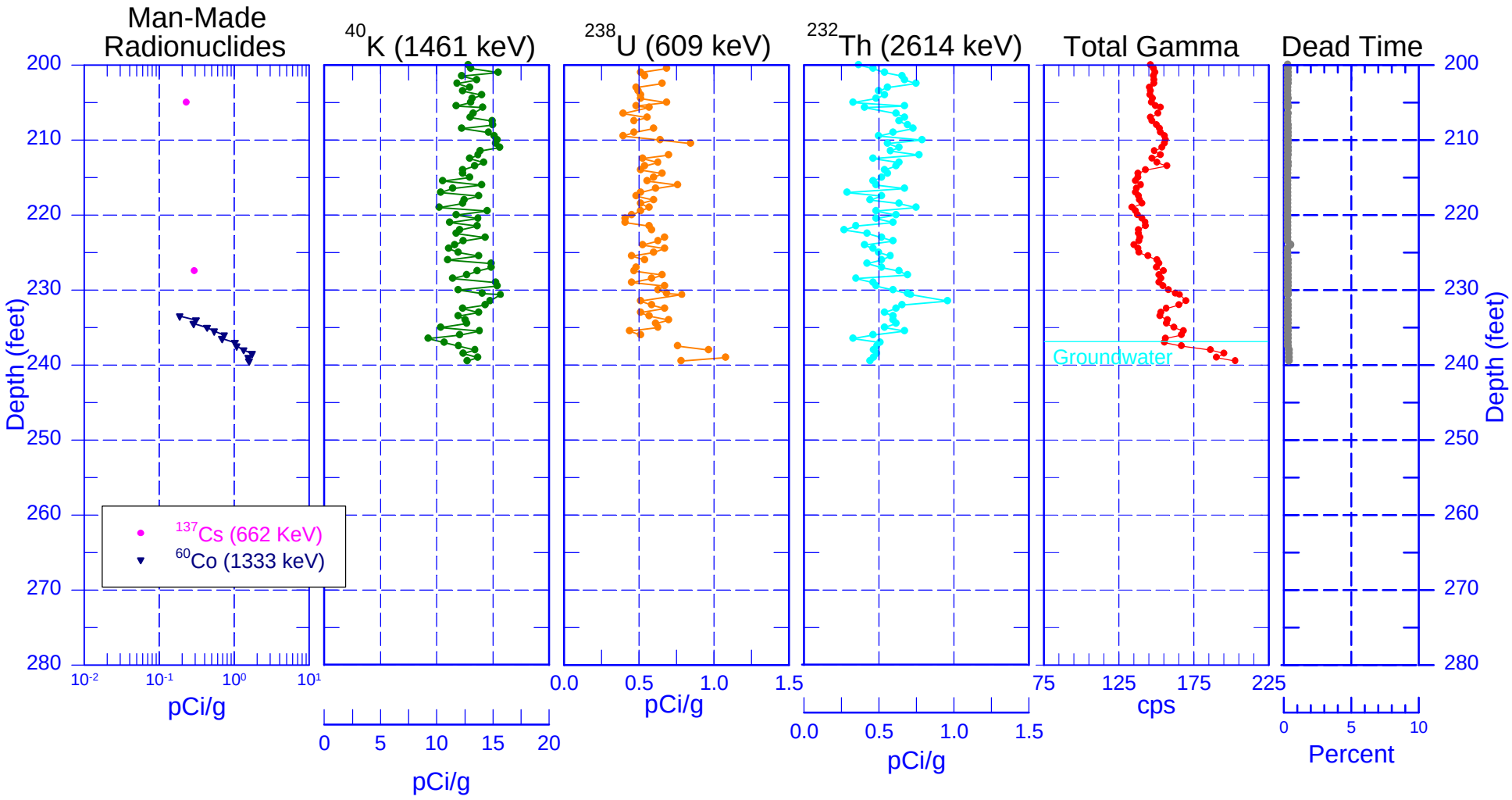
299-E33-26 (A4850) Combination Plot



299-E33-26 (A4850) Combination Plot



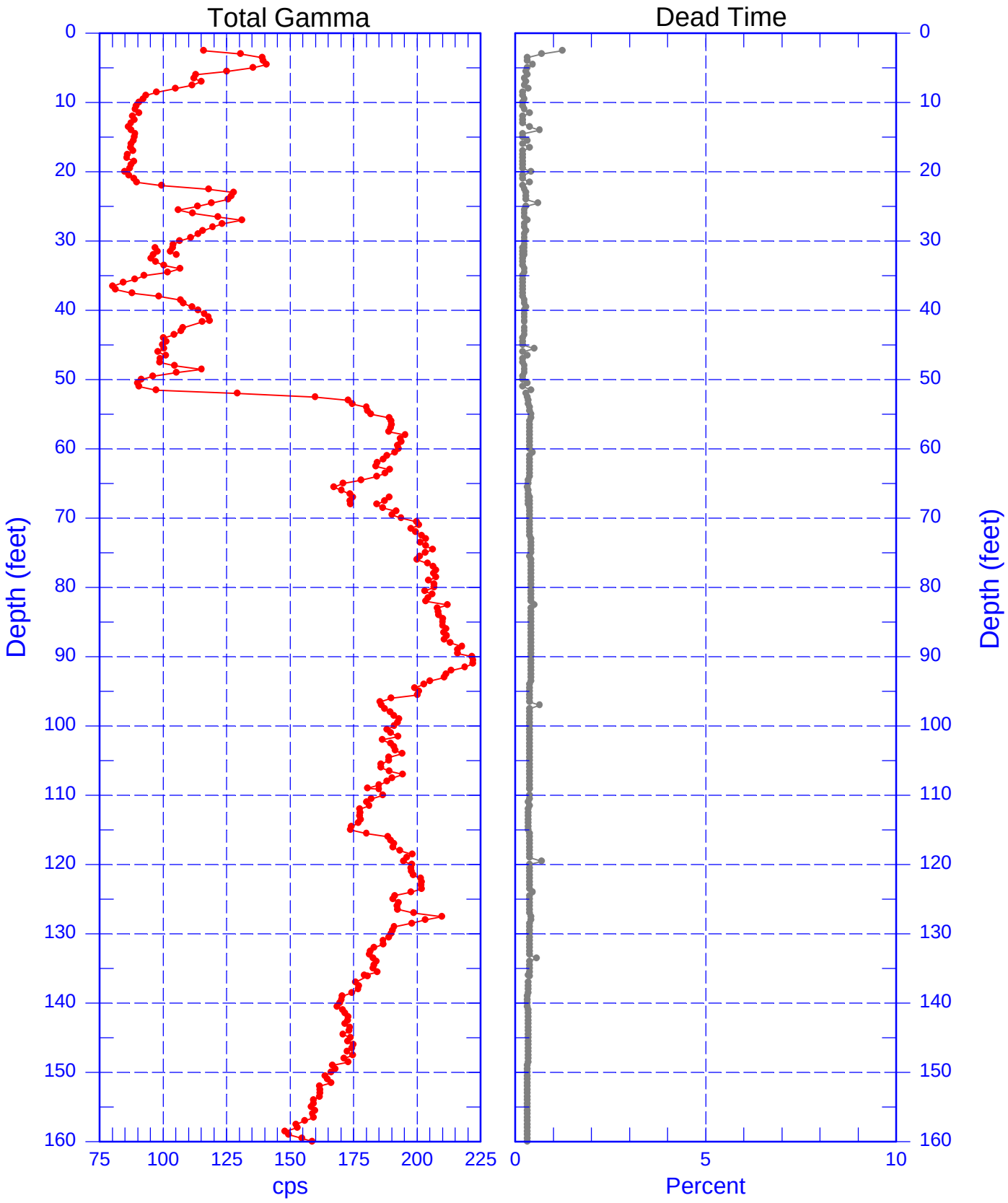
299-E33-26 (A4850) Combination Plot



Zero Reference = Top of Casing

Date of Last Logging Run
09/24/2002

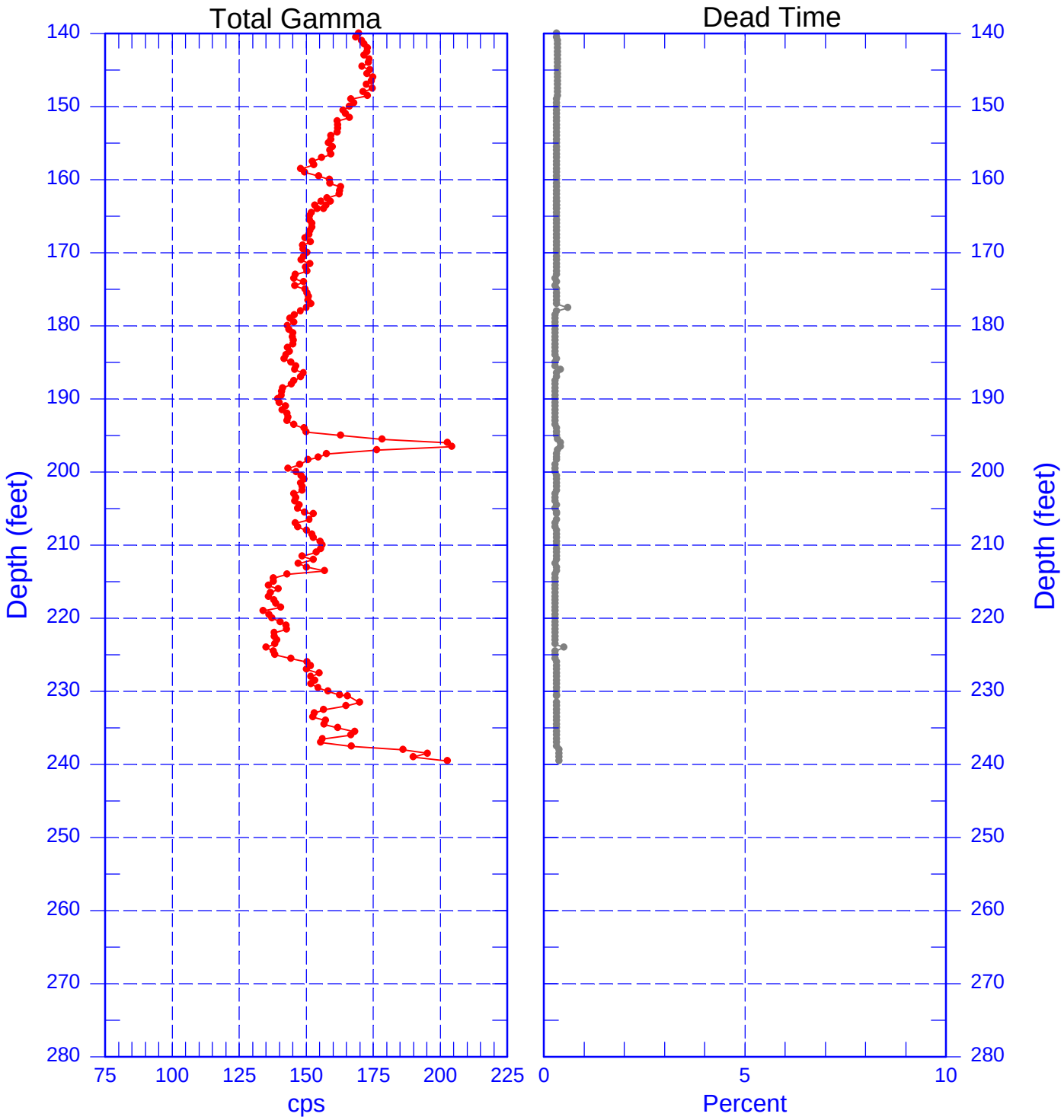
299-E33-26 (A4850)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
09/24/2002

299-E33-26 (A4850)
Total Gamma & Dead Time

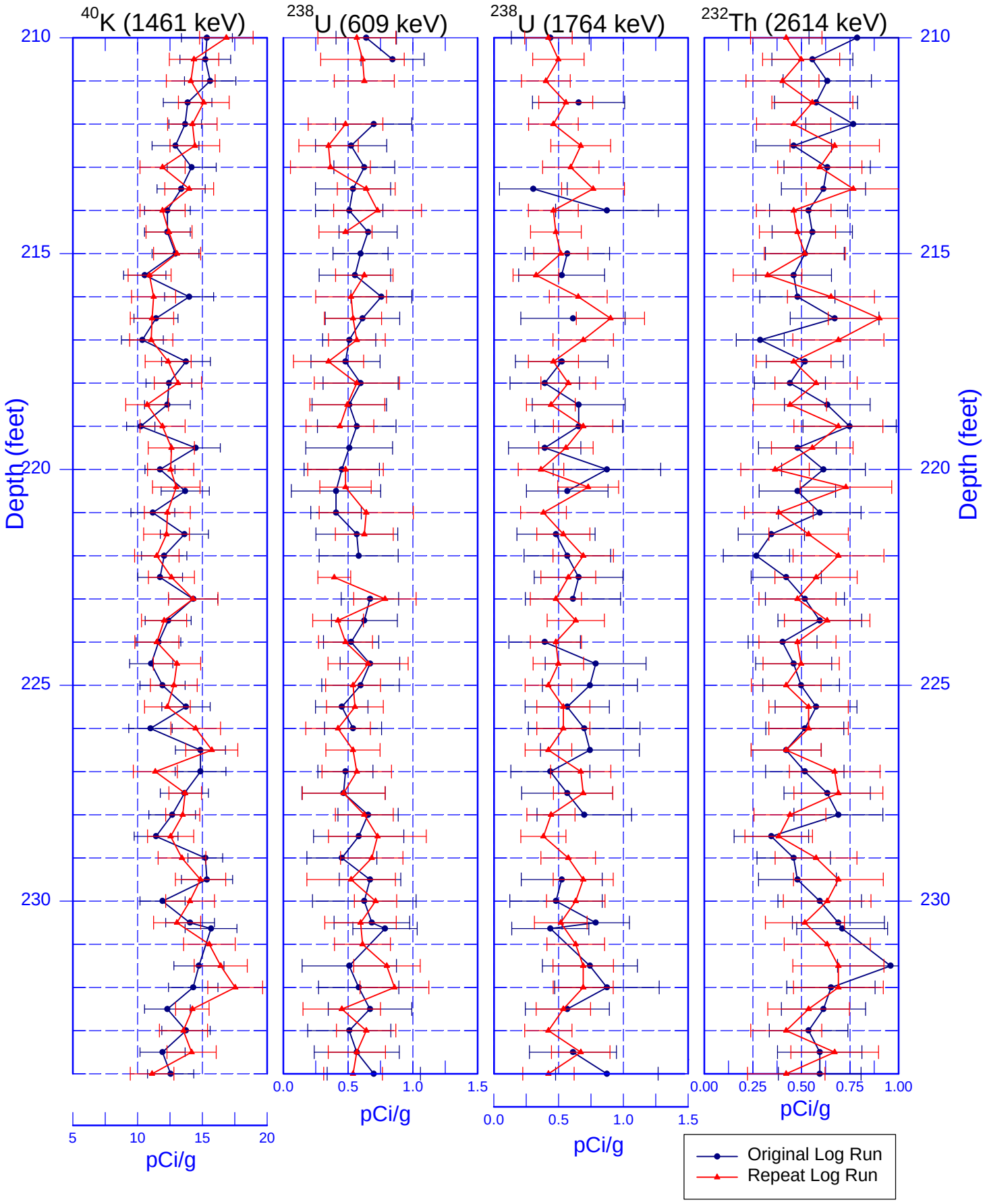


Zero Reference = Top of Casing

Date of Last Logging Run
09/24/2002

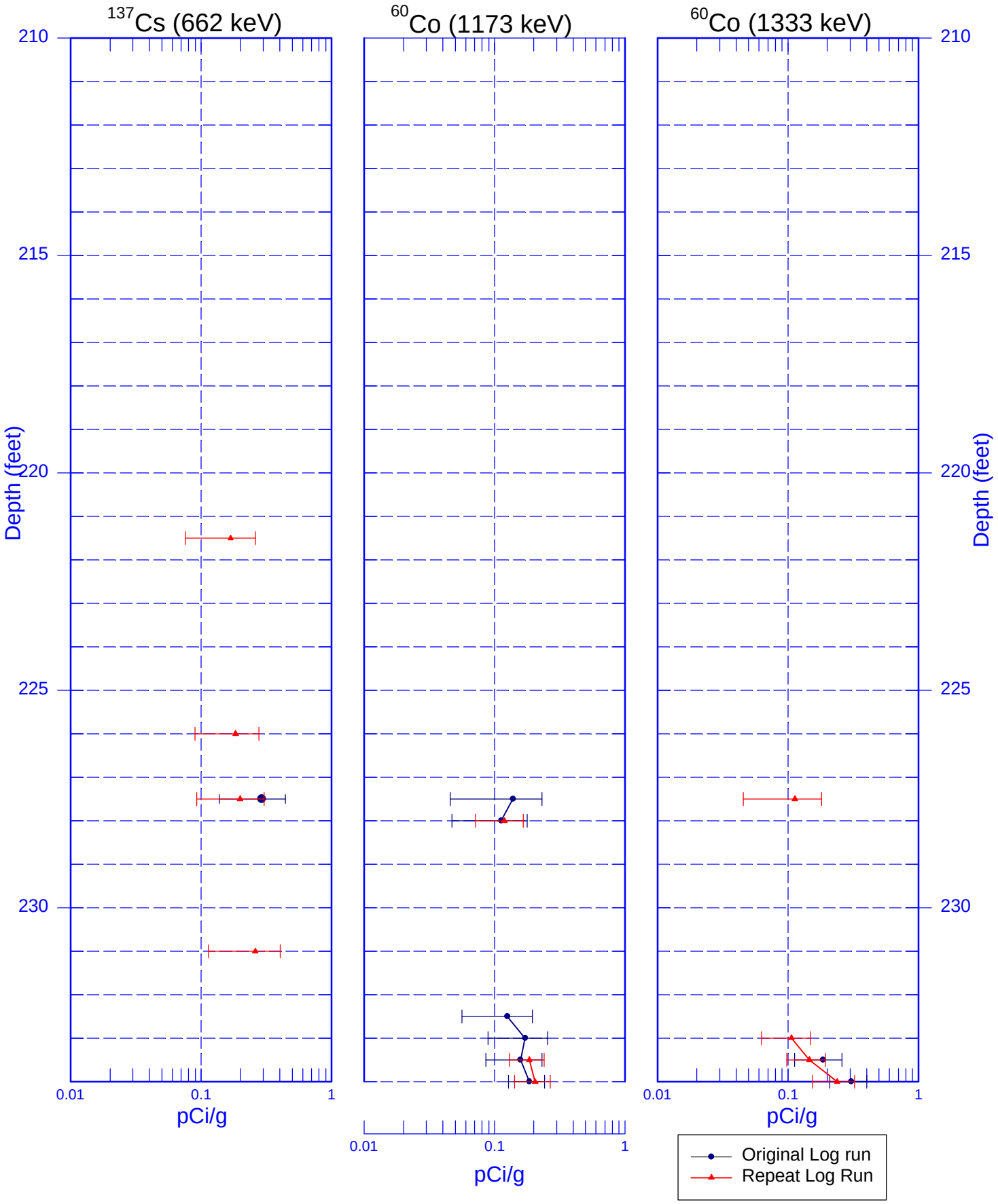
299-E33-26 (A4850)

Rerun of Natural Gamma Logs (234.0 to 210.0 ft)



299-E33-26 (A4850)

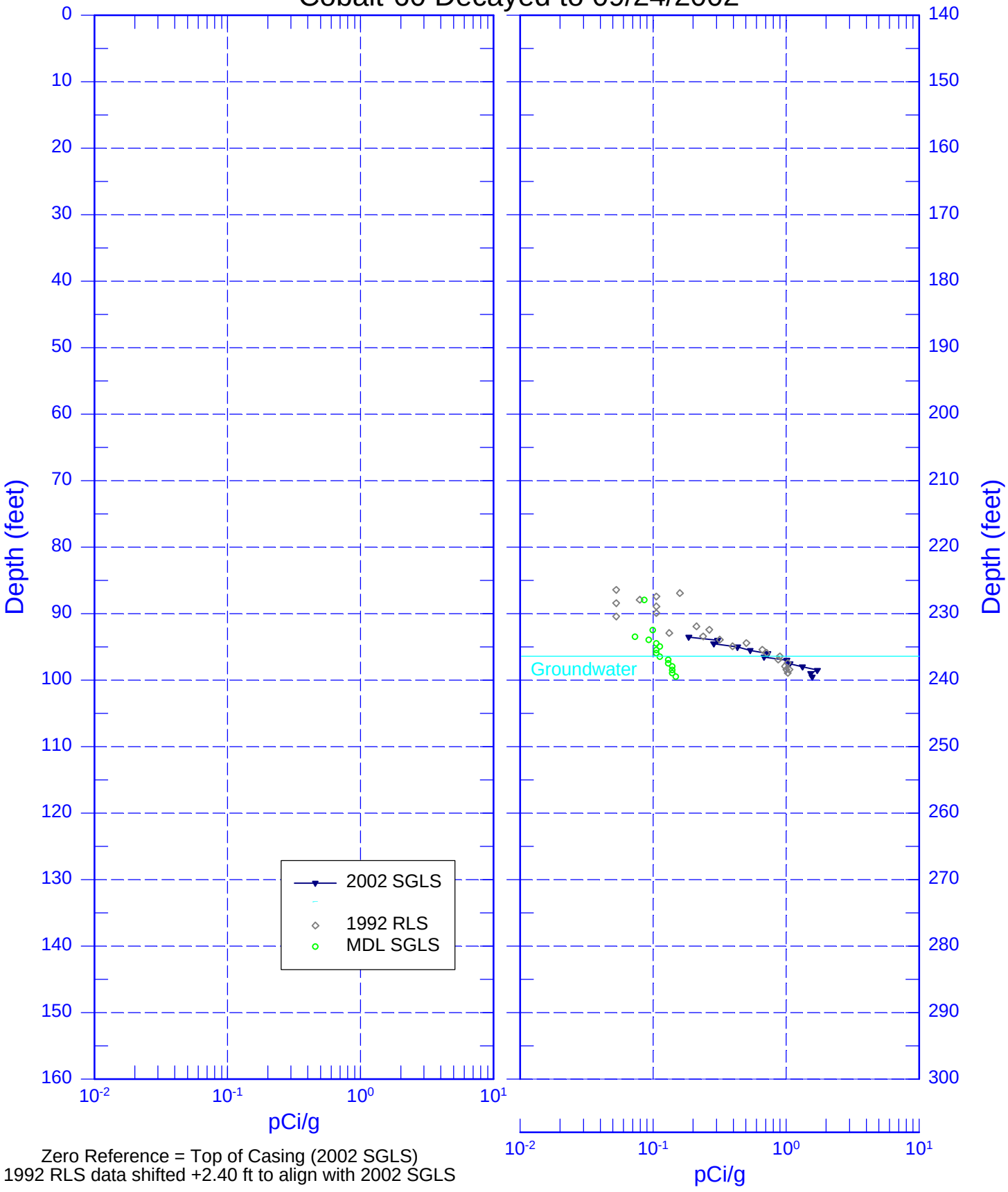
Rerun of Man-Made Radionuclides (234.0 to 210.0 ft)



299-E33-26 (A4850)

RLS Data Compared to SGLS Data

Cobalt-60 Decayed to 09/24/2002

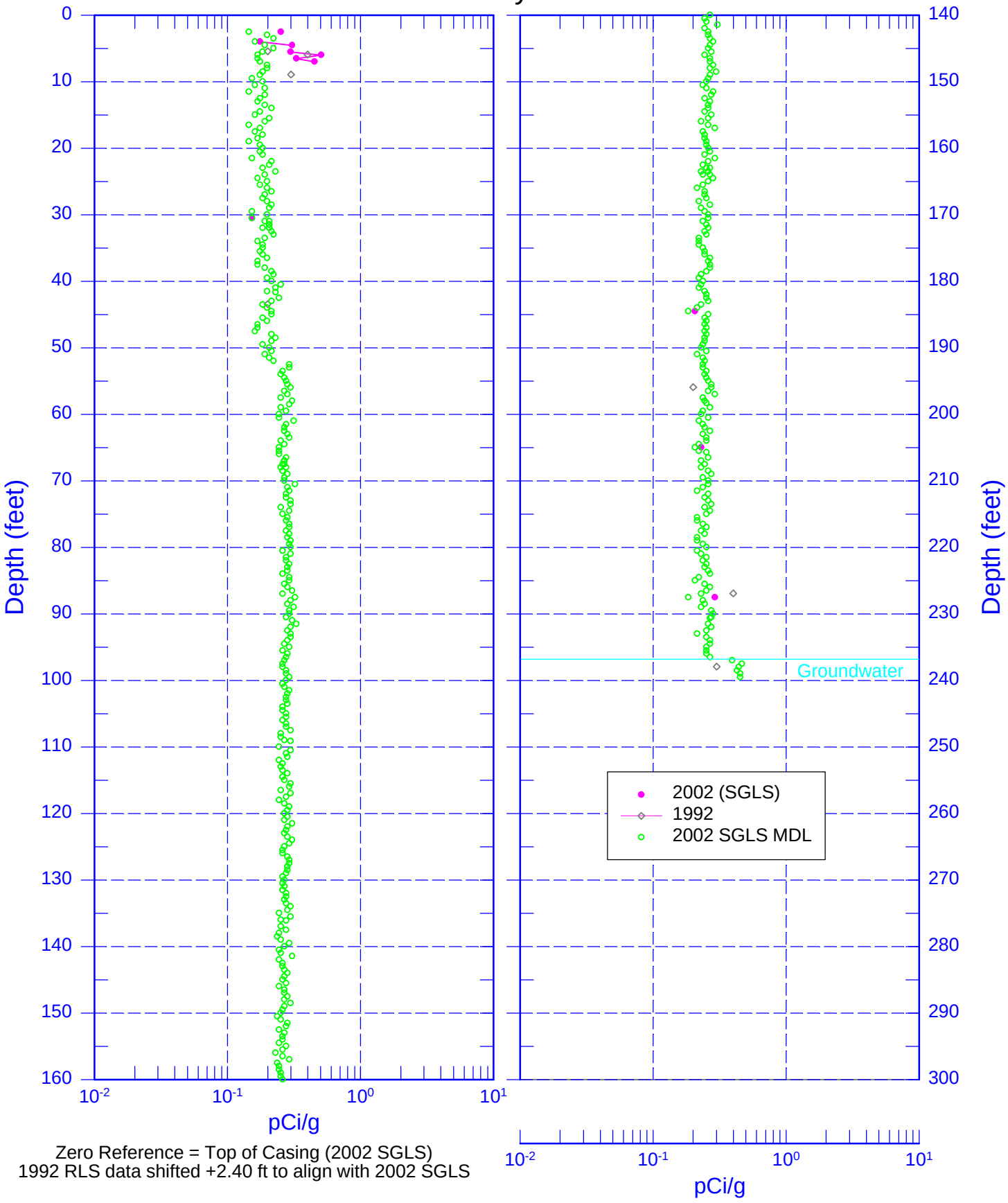


Zero Reference = Top of Casing (2002 SGLS)
1992 RLS data shifted +2.40 ft to align with 2002 SGLS

299-E33-26 (A4850)

RLS Data Compared to SGLS Data

Cesium-137 Decayed to 09/24/2002



Zero Reference = Top of Casing (2002 SGLS)
1992 RLS data shifted +2.40 ft to align with 2002 SGLS